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Botany

WHEAT

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FIELD MUSEUM OF NATURAL HISTORY
DEPARTMENT OF BOTANY
CHICAGO, 1922

LEAFLET NUMBER 3

Wheat

Mankind has undoubtedly always used the seed of wild grasses for food. Some of these, indeed, furnish very fair-sized grain and from such our cultivated cereals are unquestionably derived, though we cannot now always trace them to their respective wild prototypes. An example of such a large-grained wild grass is the recently discovered Wild Emmer of Palestine, which is considered by some to represent the original wild form from which certain of our cultivated wheats were derived.

Among the cereal grasses, wheat is by far the most important to the western world. It was first brought to this continent into Mexico by the Spaniards in 1520, later into New England and into Virginia by the early settlers. In Europe and in Asia it has been grown for thousands of years. In Europe it has been discovered in various places in remains of the later Stone Age. It has been grown about the eastern end of the Mediterranean and in Mesopotamia for at least five or six thousand years. It was cultivated in Babylonia and has been found in ancient Egyptian graves. To the far east it was grown in ancient China, to the south in India, and in Abyssinia in Africa. Its presence in several varieties even in Europe in pre-historic times and its ancient wide distribution would seem to be evidence that the beginning of its cultivation belongs to the earliest history of mankind. Unless the cultivation of wheat was undertaken independently in the various regions, its place of origin must be con-

sidered to coincide approximately with the location of a probable early center of dispersion of the human race in the old world. This is generally placed in central Asia, perhaps somewhat to the westward, about the region of eastern Turkestan where climatic conditions in the time of primitive man are likely to have been more favorable than they are now.

Some primitive wheats are still grown to an extent in Southern Europe. These are Einkorn, Emmer and Spelt. They are stamped as primitive by certain characteristics which they share with the wild grasses of the genus *Triticum* (an old Latin name for wheat) to which they belong. Like these they have a fragile, articulated head which breaks into segments on threshing, and their mature grain refuses to separate readily from its envelopes. In the other cultivated wheats the axis of the head is stout and not articulated, resisting breakage, while the ripe grain comes away easily and clean.

In the illustration, Nos. 1, 2, and 3 represent wild grasses related to wheat. Nos. 4, 5, and 6 are the primitive cultivated wheats.

No. 4. Einkorn, one-grained wheat, is so called because it has a single seed in each division (little spike or "spikelet") of the head. It yields a scanty crop but will grow in stony ground and is still cultivated to a small extent in mountainous South European regions—notably in Spain. It has been found in the remains of the lake dwellers of the stone age. The wild form still grows in Southeastern Europe—e. g. in Serbia.

No. 5. Emmer, also known as starch wheat or two-grained spelt, is another bristly or awned form with a flattened head. It exists in many varieties. It was cultivated by the ancient Babylonians, Egyptians,

Persians, and by the Greeks and Romans. It has been identified in remains of the Swiss lake dwellers. It is still grown in mountainous Switzerland, in Russia where it is used for a gruel, in Germany, in Italy and in Spain. It is grown somewhat in the United States. The illustration is of a Black Winter Emmer.

No. 6. Spelt, is usually stated to be the oldest of the cultivated grains and considered to have been the wheat of Egypt, Greece and Rome, which is probably partly erroneous, due to a confusion with Emmer. It was cultivated, however, by the Romans in the later days of the Empire. A wild prototype is not known. It is still grown in some South European localities, particularly in northern Spain.

No. 7. Polish Wheat, sometimes called "Jerusalem rye" or "Giant rye," is a hard wheat of very characteristic appearance due largely to the length of the papery bracts of the individual spikelets. The grain is elongated, resembling rye, and falls readily from the mature head. In spite of its name it is not a native of Poland. It is cultivated in Spain, in Italy, in Turkestan and in Abyssinia. It is also introduced into the United States, but to date is not of much economic importance.

No. 8. Poulard Wheat is also known as English Wheat, and a variety known as Rivet Wheat, is grown in England, but Poulard Wheat belongs of old to the dry eastern and southern Mediterranean region. It has a tendency to "sport," forming branching spikes or heads and hence is variously called Miracle Wheat, Seven-headed Wheat of Egypt, Jerusalem Wheat, etc. The illustration is of a variety known as Alaska, grown in the United States. In spite of the large size of the heads of the Poulard Wheat, the yield is not great and not equal in quality to some of the common wheats. It is of slight economic importance.

No. 9. Club Wheat is so named from the shape of the heads which are short, thick, and often broader near the tip than below. The grain is soft, the stems are short and stout. It belongs to rather mild climates and the mountainous districts of Europe, Turkestan and Abyssinia. It is introduced on this continent, and is grown particularly in Chile and in the Pacific and Rocky Mountain States.

No. 10. Durum Wheat is an extremely hard, flinty wheat from Russia, brought to the United States by early immigrants. It is economically important, as are those which follow. The flour produced from it is higher in gluten and conversely lower in starch content than other wheats and is used in the manufacture of semolina and macaroni and other pastes. For bread making it is sometimes mixed with flour of the more starchy, softer wheats. Durum Wheat, also, is said to have been found in old Egyptian remains. It is grown in India, in Algeria, and is the principal wheat crop of Spain. It is resistant to rust and is especially adapted to somewhat arid land, being also resistant to drought. On this continent Durum is grown successfully in South and Central America, and in the United States in the Great Plains Area, particularly towards its Rocky Mountain border. The illustration is of the variety Arnautka which grows well in the more humid eastern portion of the Great Plains.

No. 11. Turkey Wheat, originally from South Russia, the Crimea, etc., is now the leading hard winter wheat of the United States and endures well the low winter temperature of the Northwestern States, except where the climate is very severe, as in North Dakota.

No. 12. Wilhelmina, a stout, soft white wheat from Holland, represents a type of winter wheat commonly grown in North Europe. It has been introduced into the United States.

No. 13. Pacific Bluestem, an Australian variety, somehow misnamed "bluestem," is the leading soft white spring wheat of the Pacific area.

No. 14. Dicklow, a soft spring wheat cultivated under irrigation in Idaho and elsewhere, produces a remarkably large head. It was originated by a Utah farmer, Dick Low, through selection from variants of a California Club Wheat.

No. 15. Marquis Wheat originated in Canada, by selection from hybrids of a hard, red wheat from Calcutta, India, and Red Fife Wheat. It is the leading, hard, red, spring wheat of the Northern Great Plains area.

No. 16. Red Fife Wheat is one of the principal hard spring wheats of the Great Plains Region. It originated in Canada among a few plants, from a sample winter wheat from Russia. It now represents a parent stem from which many varieties of northern wheats have been derived.

No. 17. Kitchener Wheat is another hard, spring wheat of the Red Fife type from the plains of the Canadian northwest.

The varieties of common wheat are very numerous. According to a survey by the Department of Agriculture over two hundred, well defined kinds are recognized in the United States. There are bearded and smooth wheats, hard and soft, red and white, spring and winter, etc. Of the common wheats shown in the illustration (Nos. 11 to 17) Turkey Wheat is the only bristly, bearded, or awned form, the others are almost awnless or entirely beardless. The well-known division of wheats into spring and winter wheats has reference to their resistance to cold, but also to ability to mature their seed in a single, short growing season. The grasses from which the cereals are derived are

perennials while the cultivated cereals are, on the whole, annuals. The ideal climate for wheat is one with a mild winter, a cool and moist spring conducive to abundant development of the vegetative part of the plant, followed by a warm, dry summer for rapid ripening of the grain. Wheats which in their proper latitudes withstand the low temperature of winter without injury are known as winter wheats. True winter wheats are "winter annuals" only and will not ripen seed when sown in the spring. They are sown in the fall, and germinate and form roots before the onset of cold weather. Starting in the spring with a partly developed root system they make a vigorous, early growth. They ordinarily show a higher yield, are more likely to escape rust, and mature their grain earlier than the spring sown wheats. The spring wheats are more tender varieties that complete their growth in one season and in spite of a later start mature their grains. In northern latitudes only spring wheats can be grown. In mild climates both spring and winter wheats may be grown from fall sowing. As a rule the hard winter wheats are more resistant to cold than are the soft, but all wheats naturally belong to somewhat more moderate climates than their northerly relative rye.

Hard and soft wheats differ in the composition of the grain. The soft wheats are richer in starch and are likely to have large grains, while the hard, with smaller grains, are relatively richer in gluten. Flour made from soft wheat is esteemed for cake and pastry making, but by itself is "weak" and out of a given quantity does not make a large loaf. Hard wheats make a "strong" flour which, on account of the binding properties of gluten, retains the gas produced by the yeast and make a light loaf. They are now generally mixed in different proportions for various purposes.

Under normal conditions the chief wheat-growing countries in order of quantity produced before the world war were: United States, Russia, France, India, Italy, in the first rank; Spain, Austria-Hungary, Germany, in the second; followed by Canada, Argentina, Turkey and the United Kingdom. The latter is the chief importing country. The order, however, varies with the period considered. The wheat production of Canada and of Argentina has been steadily rising. Northern India, China, and Australia produce wheat in considerable quantities. In order of normal per capita consumption of wheat, France came first, then New Zealand, Australia, United States, Great Britain, Austria-Hungary, Germany and Canada.

The statement is not infrequently made that the world's wheat production has reached its limit, but this is far from the truth. While the older method of milling prevailed, pulverizing the entire wheat for flour, the softer wheats were preferred and wheat growing was largely restricted to regions producing them. With the introduction into the flour mills of the steel roller process, by which the contents of the kernel are simply squeezed out of the husk, it was found that a most desirable, better keeping flour could be produced from hard, northern and western wheats. Wheat growing in the United States thereby received a great impetus and the producing area was vastly expanded over the great plains. By the opening of new regions like Siberia and by the introduction of suitable, perhaps new, varieties such as undoubtedly will result from scientifically conducted, systematic breeding experiments, the world's wheat production certainly is capable of considerable further expansion.

B. E. DAHLGREN.

THE ORIGIN AND CLASSIFICATION OF WHEATS.

The three primitive wheats (Nos. 3, 4, 5) are considered by one authority to be representative respectively of three groups, each derived from a different wild prototype, viz., Einkorn group (No. 4 only); Emmer group (Nos. 5, 8, 9, 10); Spelt group (Nos. 6, 11, 12-17).

The generally accepted botanical classification of wheats is as follows: Einkorn (*Triticum monococcum*), Polish Wheat (*Triticum polonicum*), Wheat and Spelt (*Triticum sativum*), the latter subdivided into three races, viz., Spelts (*T. spelta*), Emmers (*T. dicoccum*), and Wheats (*T. tenax*), the last comprising four subraces: Poulard Wheat (*T. turgidum*), Durum Wheat (*T. durum*), Club Wheat (*T. compactum*), and Common Wheat (*T. aestivum*), with numerous varieties.

The exhibits in the Field Museum of Wheat and of other Cereal Grasses are to be found in the Department of Botany, Halls 25 and 28, on the second floor.

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